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SOME TRENDS IN MARINE SCIENCE

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The principal object of marine science is to provide the information necessary to catch fish and get them to the market in good condition, at a price people can afford to pay. These are the accomplishments that pay for marine research. The trends are the philosophy and techniques employed to these ends.

The success of commercial fishing depends primarily on assured ample stocks of fish in known localities. Normally there are wide fluctuations in the stocks available in the fishing areas. When a fishery is small compared to the available stocks of fish, these fluctuations are of little concern. Except for catastrophies there are always enough fish to support the fishery. However, when the fishery utilizes a large proportion of the stock (20% to 30%) the fluctuations become important, because they affect the earnings of the fisherman. As a fishery grows and the fluctuations become economically important marine science is invoked to alleviate the situation. Such studies follow distinct patterns to determine the causes and magnitudes of the fluctuations, to determine if they can be controlled or predicted, to determine the maximum sustained yield, and usually to find new fisheries to supply the demand. Thus the state of development and trend of marine science is closely associated with the degree of exploitation of the local fisheries.

Assuming that there is a fairly constant fishing effort, it may be reasoned that fluctuations of the fishery are due to variations of the population, or variations in their location. The success of a fish population depends on the success of spawning, survival of the young, adequate food, and suitable climatic conditions in the habitat. Variations in location of the fish or migration route probably depend on climatic boundaries and/or the location and amount of food.

Most of the established fisheries are in coastal regions and are associated with the spawning period. The behaviour of the fish at this time is well known from the experience of the fishery. The rest of their life history is usually vague. The traditional, and still the best method of determining the life history is to explore the supposed habitat, to find the fishes in all seasons, and in all stages of development, and form a complete picture. These studies must be continued over a long enough period to observe the fluctuations. They must be supported by corresponding studies of the environment, climate, predators, food supplies, and variations in all of these which may affect the success of any generation (year class) in the fishery. They must extend far enough and deep enough to define the limits of the habitat. Repeated surveys determine the fluctuations in each feature, and allow their correlation to determine the degree to which each is limiting. These studies may be

resolved into marine biology dealing with life history, habits, and food of the fish; and oceanography dealing with the aquatic climate, environment, and its fertility and productivity.

In general fish are local animals, severely limited by climate and environment. Each species is limited to Tropical, sub-Tropical, sub-Arctic, or Arctic climates. In most cases they are indigenous to oceanic, coastal, or inshore environments, through all or part of their life history. The stocks (races or groups) within each species are suited to small localities, particularly at spawning time. Groundfish and reef-fish usually remain in one locality throughout their life, and stocks are associated with particular bays, banks, and reefs. Stocks of anadromous fish usually school and seek particular bays or rivers to spawn, but disperse seaward and mingle with other stocks during their feeding and growing period. They are readily identified by locality at spawning time, but identification is difficult in the periods of dispersion. For this, morphological and seric methods of identification are being developed. In sub-Arctic herring it has been found that the growth-rate and number of vertebra decrease with increasing latitude. In the North Pacific Salmon Investigations one of the problems is to distinguish stocks of Asiatic and North American salmon in the region of mingling around the Aleutian Islands. A remarkable degree of distinction has been found in the internal parasites and blood types. No doubt these techniques will be developed and applied to other fisheries. Methods for identification of stocks of oceanic fish such as tuna, albacore, pomfret, etc., are being sought but have not been developed. There is no doubt that each species is limited to definite climatic zones. Within these zones it is assumed that there are stocks associated with localities of food abundance. However these are not yet catalogued.

The potential yield from a fishery depends primarily on its population. This is difficult to assess. It can only be estimated from the commercial catch when the whole stock is being exploited with a known consistent effort. Such fisheries and control are rare. Tagging or marking is the most generally accepted method of estimating stocks. In this procedure a number of fish are caught and marked by tagging or removing a minor fin, and released. The number of such fish caught in the commercial fishery are observed. It is assumed that the ratio of marked fish released to those caught, is in the ratio of the population to the total catch. This assumption is only true if all parts of the stock are uniformly marked, that marking has no effect on the behaviour and survival of the fish, and that all marks taken in the fishery are recorded. Lacking these conditions, elaborate statistical treatments of the data are necessary to attain even approximate results. However, every effort is being made to determine the effects of marking on captive fish. Tags and techniques are being improved. It has been found that the rewards usually offered to fishermen for reports of marks do not insure the return of tags. It is necessary to station observers at fishing ports, and on motherships to examine catches, recover marks, and get the auxiliary information by direct questioning.

Prior to World War II, exploration for new fisheries was concerned with extending the boundaries of existing fisheries in likely coastal regions. Generally these were commercial operations undertaken by the more venturesome fishermen as a result of crowding in the known fishing areas, and the improvement of ships and gear. Such explorations did not reach onto the high seas.

Since the War, fisheries research agencies have undertaken extensive exploratory fishing in coastal and high seas areas. The most extensive work has been for tuna in the Tropic and sub-Tropic Pacific, and for salmon in the sub-Arctic Pacific. These have markedly affected the knowledge of the range and behaviour of the fishes, and have introduced new gear and methods to meet the different situations.

Research in fishing gear is always continuing and has made extensive use of new materials, such as nylon nets, plastic floats, etc., and has evolved new forms of gear such as the mid-water trawl. The use of echo sounders to locate schools of fish was begun before the War and has become accepted practice in the major fisheries. Since the War, the use of horizontal sounding ranging gear has been initiated. With some technical improvement, there is no doubt that this method of locating fish will become general.

There is no doubt that the primary occupation of fish in the sea is to find food. Obviously their survival and well-being depend on it. Fluctuations in food supply must be reflected by fluctuations in the survival and size of the fishes. Commercial fishes feed on smaller fishes, but mostly on zoo–(animal) plankton. These feed on phyto–(plant) plankton, which in turn is photosynthesized from the nutrient elements in the sea. This basic productivity depends on the presence of phyto-plankton spores, the fertility (presence of nutrient elements) and suitable light and climate conditions.

Water, carbon dioxide, and spores are always present in the euphotic (lighted) zone of the sea. Hence fertility depends on the presence of the nutrient constituents such as nitrates, phosphates, silicates, and probably several others. The waters become productive when there is sufficient light and heat to support photosynthesis. During this process the nutrients in the euphotic zone are utilized. The plankton blooms, dies, sinks slowly, decomposes, and releases nutrients at some depth below the euphotic zone. Thus the nutrients are withdrawn from the upper lighted levels and concentrated in the deeper waters. In the Tropics where there is always adequate light, productivity is associated with regions of upwelling where deep water approaches the surface, replenishing the supply of nutrients. These regions become fertile, productive, zooplankton flourishes, and fish should occur.

Recently this concept was given spectacular confirmation. Physical oceanography indicated a region of upwelling along the North Equatorial Current in the Eastern Pacific. It was reasoned that this region should be fertile because of the consequent enrichment by nutrients. Furthermore it should be productive because there is adequate light and heat. Consequently there should be ample food for the indigenous tuna. A tuna fishery in the region was predicted, was found, and is being exploited.

In the North Atlantic Ocean the concentration of nutrients is generally low. They are utilized by the spring bloom of plankton, productivity ceases. In Winter the storms mix the surface and deep water to restore the fertility, but productivity is small because the water is cold and the light intensity is low.

In the North Pacific (north of latitude 40° N) the concentrations of dissolved phosphates and silicates are higher than anywhere else in the euphotic zone of the World's

oceans. However, the productivity is no greater than in corresponding Temperate and sub-Arctic areas elsewhere. It is probable that productivity is limited by the available light, in this cloudiest of all ocean areas.

The role of light in the productivity in the sea is obvious, but has been neglected. Now the studies are being initiated and going forward in the leading research centres in America and Europe.

The factors of climate in the sea are the temperature, and the salinity and dissolved oxygen concentration in the sea water, and the light intensity. Fish are acclimatized to the normal range of these climatic factors in their chosen environment. Fluctuations beyond these normal ranges can cause fish to die, or desert their usual haunts to find more suitable conditions.

The plankton in the seasonal regions varies from a minimum in Winter to a maximum in Summer, and the species bloom in an annual sequence which is obviously related to season. Furthermore the bloom of any species varies widely with the local conditions. Evidently the food plankton is even more susceptible to climate than the fish. Bearing in mind that fish, like most cold-blooded animals, can go for long periods without food, it is difficult to determine whether food or climate is more important to their survival. In any case, both the fish and their food are largely controlled by climate.

In the Tropics, and below the depth of seasonal temperature variations it is observed, as would be expected, that neither fish nor plankton can tolerate any variation of temperature. The tolerance of fishes to seasonal variation increases toward the sub-Arctic regions where the indigenous fishes tolerate a large seasonal cycle of temperature. In these regions there is some evidence to suggest that the tolerance varies through the year to suit the normal seasonal cycle. It is also possible for the pelagic forms such as herring and salmon to adjust their depth to avoid extremes.

There is some evidence suggesting that unseasonable conditions affect the fisheries, by reducing the food supply, or influencing the location of the fish. Recently the philosophy has developed that fish react to seek optimum conditions. The Grand Banks off the Atlantic Coast of Canada, at the confluence of the Gulf Stream and the Labrador current, supports the World's greatest cod fishery. Normally the temperature of the water on the Banks is 5° to 7° C. Occasionally the deep, very cold (less than 2° C) Arctic waters rise over the Banks. When this occurs the cod leave the area and the fishery fails. Fish leave the populous Peruvian fishery during periods of "El Nino" when the Peru current shifts or weakens, and the temperature of the water falls. Herring in the North Sea move to avoid intrusions of Arctic water. The success of plaice spawning in the English Channel depends on the intrusion of Atlantic water. The northern limit of albacore migration in the Pacific depends on the northern limit of the 13° C isotherm. These and many other examples indicate that extremes of climate, rather than average conditions, limit the domain of fishes.

Hence there is a trend to observe the behaviour of the fish under varying conditions of marine climate, observe what conditions they tolerate and avoid, learn to recognize, and if possible forecast these extreme conditions and so predict when and where fish will be present (or absent) in commercial quantities.

Most oceanographic studies are local, associated with local fisheries interests. The usual procedure is to cover the area of interest with a net of stations in as short a period as possible. At each station the properties of the water (temperature, salinity, and possibly dissolved oxygen and some of the nutrients) are observed at intervals of depth from the surface. The limiting depth depends on the interest and equipment. From these quasi-synoptic data the distribution of properties are determined, and the movement and mechanics of the waters are deduced. Successive surveys define successive states, the sequence of seasonal conditions, and variations of the climate from year to year.

Such surveys, though certain and definitive of the conditions at the time they are made, do not reveal the onset, duration, or decay of those conditions, or whether they are representative or transient, normal or abnormal.

In most coastal and inshore areas of serious investigation the surveys are supported by a system of daily observations of surface seawater temperature and salinity. These are usually made from lighthouses, lightships, and weather ships. It is assumed that major variations in the upper levels of coastal waters will be reflected in the properties of the surface water. Although the relations are not always simple they usually exist.

These two systems of observation are complementary, one defines the oceanographic states, and the other records their occurrence and duration. In some major fishing areas, such as the North Sea, the Grand Banks, off the California Coast, and in the Japanese waters, surveys are repeated at monthly to quarterly intervals indefinitely. Along the Pacific Coast of Canada intensive series of surveys are carried out in limited areas through one or two years. The oceanographic data are related to weather, land drainage, and a comprehensive net-work of daily seawater observations, and the oceanographic state interpreted from these more simply observed data.

In many parts of the World such as the Arctic, Antarctic Oceans, the Sulu Sea, Manila Bay, and the eastern approaches to India, several surveys have been made but are not supported by any system of daily seawater observations. Elsewhere, such as off the Coast of Peru, there have been regular point observations but very few surveys. Both are necessary to appreciation of the marine climate and environment, but where the choice is necessary, it must be made according to the resources.

It is obvious that no matter how efficient such surveys and daily seawater observations become, they can do no more than record the conditions that are past. Because of the time required for analyses, the conclusions usually lag behind the observations by more than a year. The real need is to predict the conditions so that the behaviour of the fishery can be forecast.

This is the role of fluid mechanics in oceanography. By resolving the observed states in terms of oceanographic processes, and relating them to causative factors, the marine physicist attempts to define cuase and effect. The corresponding research in meteorology made weather forecasting possible. Because of this philosophy, oceanographic observations have been made more precise, extended far beyond the immediate limits of the local fisheries and into abyssal depths. These data with modern computing facilities offer a hope of resolving the mechanisms of the seas, so that at least the major fluctuations in oceanographic conditions may be forecast.

GENERAL TRENDS

Fish Diet Cures Heart Disease

Two years of investigation at Camp Hill Hospital, Halifax, N.S., Canada, of patients with coronary heart disease and other forms of hardening of the arteries, have given reason to believe that consumption of fish instead of animal fats can help prevent such disease, Dr. C.M. Harlow, director of laboratories at the DVA hospital, told the Nova Scotia Dietetic Association recently.

Levels of serum cholesterol (a blood factor generally accepted to be involved in arterial disease) were lowered in several patients given regular amounts of seal oil while on diets low in animal fats, according to charts shown the dietitians by Dr. Harlow, who is also assistant professor of pathology and biochemistry at Dalhousie University.

Dr. Harlow also showed drawings of the interior of blood vessels affected by atherosclerosis (hardening of the arteries) apparently caused, at least partly, by high levels of cholesterol in the blood. Cholesterol is believed to crystallize and collect on the interior walls of the blood vessels, and thereby reduce the area open for the passage of blood. Also, as the surface of cholesterol deposited blood vessel is rough, the blood has a greater tendency to clot than it does in the normal, smooth vessel. When a clot forms, it can cause pain (angina) or can cut off the flow of blood entirely and the result, in the coronary artery, is coronary thrombosis.

"At Camp Hill Hospital, a group of us (doctors, dietitians and technicians) have for the past two years been investigating various group of patients with coronary heart disease and other forms of athersclerosis of the blood vessels.

"We have used seal oil, a soft marine fat, to supplement lowered animal fat diets. To date we have had excellent results in the lowering of the blood cholesterol and in the generally improved physical condition of the patients. As yet, because of the technical impossibility of examining the internal blood vessels, we have no way of telling whether there is a regression of atheroma in their arteries. Our only guide is the unscientific evidence of the general improvement in the patient's health," Dr. Harlow said.

The Camp Hill research, although Dr. Harlow pointed out that it has not reached final and definite conclusion, has indicated what could be an important health benefit for many people, particularly those susceptible by hereditary and dietary factors to heart disease. It opens up the possibility that persons placed on lowered animal fat diets may get essential fatty acids from fish and that persons requiring high calorie intakes, such as men working at hard labor, can get their calories in fish fats, without running the risk of increasing their blood cholesterol. (From *Canadian Fisherman*, 44 (11) : 16, 1957).

Possibilities of Electrical Fishing

The efficiency of electrical fishing gear within its present limited field is much greater than that of any other gear used up

to now. For instance, only by electrical fishing is it possible to take all fish and other animal life from closed waters and definite water areas. Undrainable ponds, lakes and pools can be fished out completely by using electrical gear. The gear can also be used for removing useless and predatory fish. Any water, particularly river areas, can be fenced against migrating fish, which enables fish culture to be carried on in selected water areas. Electrical barriers can prevent valuable commercial fish, such as eel, salmon, etc., from entering turbines, pumps, etc., where they would be damaged or killed. Electrical gear can also be used to guide fish to new river systems and fish ways, or to drive them, by frightening effect, into fishing gear, such as traps etc.

The use of electrical gear is also developing in sea fisheries, and it is now possible to concentrate shoal fish by keeping an electrode before the aperture of a trawl net and to paralyse the fish so they cannot escape the trawl.

An electrode placed in front of a pelagic (midwater) trawl will attract shoal fish even from the lower area of the electrical field and guide them into the catching area. This means fish from the region beneath the net, which would otherwise not be taken, will be caught. An electrical midwater trawl also enables the otherwise 'unfishable' uneven bottom to be fished as the fish living near the ground are attracted towards the electrode.

The blocking effect of electric current can also be used in the sea fisheries. Narrow areas, such as fiords, could be electrically fenced and the fish kept in them until required. It might even be possible to drive fish shoals towards a destination much as a shepherd and his dogs drive flocks of sheep.

An electrical shark barrier might also be constructed on that principle.

And there is no doubt about the great importance of the improved quality of the flesh of fish which are paralysed or killed electrically thus preventing the accumulation of lactic acid during the death struggle and delaying the onset and disappearance of *rigor mortis*.

Despite these advantages, however, it should not be forgotten that the capital and energy expended for electrical fishing should be kept in reasonable relation to the practical results achieved by the gear. (*From* **Electrical Fishing**, *FAO Fisheries Study*, No. 7, 1957).

Gadget to Keep Trawl Mouth Open Vertically

Mr. Y. Grouselle of St. Malo, France, has patented and put on the market a device, which he claims, will keep trawl mouth open vertically without increasing the drag effect.

Called the Exocet, the device is in effect a framework which carries a rectangular panel at an angle of 30° which, in turn, has provision for 2 or 3 floats of conventional design. This, it is claimed, entirely obviates the objection of the ordinary method of holding the mouth open with floats with which it is found that at about 3 knots the resistance set up against forward movement is greater than the rising force,

so that the opening is diminished instead of being increased.

The problem of producing something sufficiently simple and light, easy to handle, yet solid and able to hold its essential position in the water, having the greatest possible lift, was solved by using aluminium alloy in the form of a rectangle with rounded corners, reinforced round the edges with flanges, and having provision for the floats near the leading edge.

The device is fixed to the headline at the top of the trawl, so that the rectangular part is held at an angle of 30° to the horizontal. The rising force increases *pro rata* to the speed of trawling, as the mouth of the trawl is forced open by the force of the water against the inclined plane. Catches are increased as the mouth of the net is enlarged. A ground can be fished effectively at much higher speed. The risk of tearing the net is also much reduced.

The effect of the device is claimed to be constant under all trawling conditions. It has been used by trawlers of all types and proved itself on the ground.

Danish Cold Processing Method

A Danish engineer, H.M. Ehlert, has developed a method which makes it possible by cold processing (without the traditional heating of the raw material to 212°F. or more) to extract the oil from industrial herring and other fish. The manufacturing process is very simple, and it is claimed that the herring oil produced is odourless.

The new and unusual part of the method is that with the help of enzymes the fish is liquified by cold processing and the oil separated by centrifuging. The first machine installed by a Danish firm manufactures partly oil and partly de-oiled liquid herring. The de-oiled product has unusual keeping qualities, and the method indicates a possibility of almost unlimited preservation of ground raw material.

These are the products produced experimentally by the new process to date: (1) de-oiled herring pulp, (2) herring oil, (3) spray-dried herring pulp, (4) a fodder supplement, (5) spray-dried cod fillet powder.

The new cold treatment procedure is as follows:

The fish is transformed into fluent fish pulp by chopping and mixing with certain enzyme cultures which are extracted from bacteria and fortified by more enzymes. Two methods are used since two types of cultures are provided —

(a) Using one type of culture with lean fish, the admixture can be acidulated to a pH making it adequate for storage as desired. The pulp is a highly valuable fodder supplement.

(b) Using the second type of enzymes with fat fish, the admixture can be centrifuged into oil and pulp at a temperature not exceeding 122°F. The de-oiled fish pulp can be either acidulated, as under (a) for use as a fodder supplement, or spray-dried into almost non-perishable fish powder with all the good points of the fresh fish.

The new method claims the following advantages:

(1) All the original characteristics (vitamins, enzymes, fish factors, etc.) of the fish are kept in the ideal proportion found in nature in the ready-made fish by-products.

(2) Even big quantities of fresh fish can be treated immediately after landing, thereby precluding any spoilage of raw material. The process, being short and simple, demands only very simple machinery and allows storage of the semi-processed product for later successive processing into final products.

(3) The fish oil is centrifuged from fat fish under temperatures so low that the original characteristics of the fish pulp remain intact.

(4) The proteins of the fish are hydrolized into free amino acids, which are easily digestible for humans and animals. Pulp and the fish powder therefrom have long-keeping qualities, and are rich in proteins. (*Fisheries Newsletter*, 17(1): 25-27, 1958).

White-blooded Fish in South Pole

According to news relayed by Red China from Leningrad, a white-blooded species of fish was found in South Pole waters by a Soviet expedition. The 18 fish captured from the coastal area in the South Pole waters were found to contain no red corpuscles. (*Pan Asia*, Hong kong, 23 March 1958).

In Lighter Vein

Fish Drunk by Thousands

ROME, Wednesday – Thousands of trout went on a drunken spree last night when their river was spilled with 2,642 gallons of fiery Italian liquor.

Villagers picked up the fish, which were too drunk to care, by the hundreds after a trailer broke loose from its lorry and spilled its cargo of "grappa" in the Isarco River. – **U.P.** (*Malay Mail*, 8 January 1958).

Strangest Fish Yet Caught

Reported recently from Akhabar, Egypt, is one of the strangest fish yet caught. The freak fish was caught by a fisherman in the River Nile, and seems to have a bit of everything about it. The creature has eyes slanted like a human placed in front, it has thick lips, human breasts, and also human eyebrows and from the navel down it is like an alligator leading to a scaly tail. Students Fathi Hussein Abeid and Lamloud Abeid said that they bought the creature from a fisherman for fifty piastres. – **U.P.** (*Singapore Standard*, 31 October 1957).

NEWS FROM MEMBER GOVERNMENTS

CEYLON

Japanese Experts Study Ceylon Fisheries

A team of 8 Japanese experts including one interpreter arrived in Ceylon on 8 February 1958. This team was invited by the Government of Ceylon to study the present conditions of the fisheries in that country. Included in the team was Mr. Hisayasu Hori of the Japanese Society for Economic Co-operation in Asia. Mr. Hori is Secretary-in-charge of Colombo Plan for that Society. These experts were divided into 4 groups and staff officers were assigned to assist them in their study of the Ceylon Fisheries Department activities in various fields.

It is expected that on completion of this study, the team will make recommendations for the development of Ceylon fisheries in all their aspects.

Improvement of Craft Design

The revised plans of a mechanized surf landing boat were distributed and it is hoped that one boat will be available for trial and demonstration use in the course of this year. A small number of fishermen have taken to conventional western type small fishing boats. Some of these are reconditioned naval craft, one a reconditioned departmental Danish boat sold to a fisherman, and one a new 27 ft. boat built for fishing by a local man. Two more new fishing boats are nearing completion, having been designed by a Swiss naval architect, who is now resident in the island, and constructed in his boatyard. One of these has an air cooled engine.

One outrigger canoe was constructed with a specially wide hull, sufficient to take a 5-7 h.p. Coventry Victor marine diesel engine, but in all other respects similar to the conventional outrigger canoe. This boat has been under successful commercial operation for nearly a year and the boat builder is planning to make another.

Over 70 local flat bottomed canoe type craft have been equipped with inboard diesel engines. This has necessitated a slight modification of the hull involving the introduction of a keel, and a stern post to take the stern tube. In view of the rounded lines of the stern, it has been found necessary to use a 4 ft. stern tube instead of the conventional 2 ft.

Mechanization of Fishing Craft

During 1953–57, seventy four fishing craft were mechanized; twelve more engines have been purchased since for further mechanization. The engines in use vary from 5 to 48 h.p. and are of British manufacture, principally Petter, Coventry Victor, Lister, and Perkins. One Japanese Yanmar engine has recently been purchased by fishermen.

Outboard motors have been used in the mechanization of outrigger canoes of both dug-out and planked construction. The high free board of the canoes makes it necessary to have motors with extended shafts. Penta engines, 4 h.p. low revolutions, with shafts extended by 30 and 40 cm. were specially obtained and 4 such Pentas are already in commercial use. One Seagull and Kjapp were also made available to the fishermen by the Fisheries Department.

Fishermen have directly procured Seagull and Anzani (British) outboard engines for use on canoes and log rafts.

Experiments are being conducted to determine the suitability of outboard motors for the mechanization of the small log rafts which are widely used on the west coast of Ceylon. Within the last two months the fishermen have purchased 5 outboard motors, some of which will be used on log rafts and 18 Anzani (British) are on order for raft fishermen.

Fishermen are assisted in the procurement of marine diesel engines by the Fisheries Department, which delivers the engine to the site of installation on a payment of one third of the price, the balance being paid in 22 instalments. For outboard motors, the fishermen are required to pay one third of the price, the balance being paid in 8 instalments.

Under its technical assistance programme, FAO has assisted in these activities for the mechanization of fishing boats in Ceylon, by providing expert services and technical equipment, as well as fellowships. Assistance has also been provided under Colombo Plan from Canada and Japan. Canada has provided fishing boats and expert fishermen while Japan has provided the services of an expert in small boat fishing.

Improvement of Fishing Gear

While the Government continues its efforts to secure increasing supplies of nets and line made of synthetic fibre, a fair quantity of webbing, twine and fishing line made of kuralon, a synthetic substitute cheaper than nylon, is now being imported by the trade, principally from Japan.

Cotton and hemp netting and yarn as well as fishing hooks have for some considerable time been imported to meet the needs of the local industry. Most of the cotton netting comes from India, but recently Japanese cotton netting and twine have been in great demand. Nearly all the hooks are imported, and practically all are from Norway.

Cotton lines, hooks and wire for longlines are also being made available to fishermen who receive training in longline fishing. Sets of nylon nets have been given out on loan to fishermen from stocks made available under the FAO/ETAP and sets of longlines have been issued on loan to fishermen from stocks made available under Colombo Plan by Canada. It is intended to recall this equipment after a few months, during which the fishermen will have been, it is hoped, convinced of the advantages of the new methods and gear over their old practices, and will have invested in their own equipment. The loaned equipment will then be passed on to other fishermen.

Vocational Training for Fishermen

Four Extension Officers have been appointed and trained. Their work is to encourage the formation of fishermen's co-operative societies and to demonstrate new methods of fishing and the use of new types of gear, in order that fishermen may improve their present operations. The Extension Officers are assisted by departmental craftsmen who have received training under expert fishermen. One craftsman has returned after a six-month course of training in small boat fishing in Japan under the Colombo Plan, and one craftsman is at present undergoing a similar training in

Japan. Training classes have been conducted at Education Centres which are run in collaboration with the Co-operative Department. In these classes, fishermen have been taught to make bottom longlines, shark lines and nylon drift nets. These classes will be followed by the demonstration of these methods at sea.

Demonstrations of longline, sharkline, and drift net fishing have been given to fishermen at various times on their own boats. Practical demonstration classes are also conducted at sea on the departmental exploratory and training vessels, *Canadian* and *North Star*, in which fishermen have been shown the use of the bottom longlines, shark lines, and nylon drift nets.

Under scholarships awarded by the Japanese Government under the Colombo Plan, 12 local fishermen are to be sent on a course of training in modern small boat fishing operations in Japan. Selections are being made from active fishermen who have had sufficient educational background to benefit from such an overseas training.

Training in Fisheries Bacteriology

A Research Officer in Fisheries Bacteriology, Department of Fisheries, is undergoing a 3-year course in fisheries bacteriology at the University of Aberdeen, for the degree of Doctor of Philosophy. Training commenced in November 1957. This course has been arranged by the United Kingdom, under Colombo Plan. Training was requested by Ceylon in order that the officer could on his return undertake research into the bacteriological aspects of handling, preservation and storage of fish and fish products. This branch of study is also expected to provide data for implementation of the Food and Drugs Act.

Fisheries Newsletter

The Department of Fisheries, Ceylon, has recently introduced a new series of extension service Newsletters. The Newsletters are issued in English, Sinhalese and Tamil. It is intended to make the series a monthly publication to bring to the fishermen information on the recent developments in the industry and the services which may be available to the fishermen.

INDIA

Fisheries Development in Mysore

The Mysore State Fisheries Department was established as an independent Department in May 1957 under a separate and independent Directorate.

A boat-building yard for the construction of new mechanised boats as designed by an FAO/ETAP Naval Architect is being established at Mangalore. A Centre for training fishermen in the handling of marine engines and fishing with modern gear from small powered craft is also being established at Mangalore. Surveys are being made by an FAO/ETAP Harbour Specialist for the development of fishing harbours at Karwar, Malpe and Mangalore.

Fish Culture in Madras

The Government of India this year permitted the State of Madras to culture *Tilapia* on a state-wide basis in all inland

waters. In 1953 the Madras Fisheries Department obtained 25 *Tilapia mossambica* from Ceylon. The culture of this fish on an experimental scale in the three districts of Tirunelveli, Ramanathapuram and Madurai was allowed and the Department was asked to make observations.

It was found that the culture of *Tilapia* was harmless and that the fish could well adjust itself with the indigenous varieties. Since the culture of *Tilapia* began, the State has also been getting larger yields of fish from inland waters, especially in the rural areas. The permission of the Government for extensive culture of this fish came in the wake of these observations.

Experiments with stocking of the fish in Mettur reservoir have already indicated preliminary success. These activities are soon to extend to Bhavanisagar, Amravathi Sathanur, and Manimuthar reservoirs. The establishment of a model estuarine fish farm in Adyar waters has also been taken up by the Department.

The Department estimates that with the quickened tempo of the implementation of various schemes for the exploitation of both inland and marine waters, there will be an increase of about 15 % in the overall production of fish in the State of Madras by the end of the Second Five-Year Plan.

Fry Collection and Distribution in Orissa

The fry collection operations came to a close by the month of November 1957. The total production of fingerlings amounted to over half a million, registering an increase of nearly 300 % over the previous year. Transport of fingerlings in oxygen sealed plastic containers of a special type contributed to the successful supply and more than 10,000 bags were packed and transported covering distances up to 400 miles by road. The mortality was reported to be negligible.

More Tank Fish for Punjab

Under the 2nd Five-Year Plan the State Government of the Punjab has fixed a target to raise fish production in the Patiala Division from 250,000 to 800,000 pounds by the end of 1960-61. A vigorous project for the development of carp culture will commence soon after water starts to flow from the Bhakra Dam.

The Punjab Fisheries Department is carrying out a survey in the hilly areas of Patiala Division to find a suitable site where experimental tanks may be constructed to breed Mirrow Carp (*Cyprinus carpio* var.). This fish was imported last year into the Punjab from the Nilgris. The 200 fish released in the Government tanks at Patterikham near Patiala grew very well.

About 2,000 Mirrow Carp, 2-3 inches in size, were recently brought from Nahan in Himachal Pradesh. Of these 1,000 were released in Patterikham tanks and the rest in Bir Mens tanks near Nabha. These fishes are stated to have attained a size of 6-7 inches within 6 weeks.

The Rajindra Tank at Patiala has been stocked with 2,000 Indian Carp. The State Government is considering a proposal to open this tank for the first time to the public for angling and sport. Formerly, this tank was used for angling only by the ruler of the State and his guests.

Pearl Fisheries off Tuticorin

The Pearl Fisheries off Tuticorin for 1958, the fourth in succession since revival of this fishery in 1955, will commence early

in March and are likely to last until the end of April. Karuval and Kudamuthu banks reputed to yield oysters rich in pearls will be fished. The target is 500,000 oysters a day or a total of approximately 22,500,000 for the whole season. Before its revival in 1955, the last pearl fishery took place in 1927. During these years of inactivity it was not possible to locate the fishing grounds lying scattered in the region 20 miles off Tuticorin and bounded in its outer limit by the 11-fathom line. Systematic and scientific survey of these fishing grounds initiated in 1949, culminated in a successful pearl fishery, commencing in 1955.

The pearl oyster occurring off Tuicorin is *Pinctada vulgaris*. The principal age groups in the catch were $3\frac{1}{2}$-$4\frac{1}{2}$ year olds in 1955, 3-$3\frac{1}{2}$ in 1956 and $3\frac{1}{2}$-$4\frac{1}{2}$ in 1957. The $3\frac{1}{2}$-$4\frac{1}{2}$ year olds yield the maximum pearl.

During the fishery in 1958 over 1,000 divers and 100 canoes from various parts will participate. Of the catch 66.5% will go to the Government of Madras and 33.3% to the harvesters. The Government may derive a revenue of Rs. 200,000-250,000.

The declaration of the pearl fishery is governed by a proper assessment of the oyster population and the relative proportion of the different age groups.

Design and Construction of Fish Ladders

Canada has provided a 6-9 month course for an officer of the Central Water and Power Commission of the Government of India. This Commission is vested with the responsibility of giving advice on the planning, design and construction of all major river valley projects. As such, it requires highly trained personnel on its staff, who would be competent to handle the work efficiently. Training was therefore requested in Canada, for the Assistant Director of the above Commission, in modern methods of design and construction of fish ladders.

Mechanized Fishing Boats

More than 800 mechanized fishing boats sail into the Arabian Sea along the Bombay coastline. While the conventional craft cannot operate beyond a few miles off the coast, these mechanized fishing boats go up to the 30-fathom line in order to fish in rich off-shore areas. As a result, the supply of fish to Bombay City went up from 10,000 tons in 1947 to 40,000 tons in 1956.

Besides these boats in Bombay, *Dan* and *Pablo* type vessels fitted with motor and nylon bottom gill nets have yielded encouraging results in Madras, Kerala, Mysore and Andhra Pradesh. There are now 6 mechanized craft of this type in Kerala, 21 in Madras, 4 in Orissa, and 5 in Andhra.

Part of a country-wide programme of fisheries development, both marine and inland, the mechanization aims at increasing fish production in India.

While these mechanized boats go further out to sea, exploration of new fishing grounds in the deep waters is continued. Experiments in fishing from specialized types of powered vessels employing such gear as trawls, gill nets and longlines are also being conducted in Cochin, Bombay, and Calcutta.

Since the success of Government operated bull-trawling, private enterprise in slowly taking over these operations. A company has been operating with four bull

trawlers off Bombay since 1956 and has obtained highly satisfactory results.

Fishing Harbour in Kerala

Mr. Svendsen, Danish harbour expert, who came to India at the invitation of the Indo-Norwegian Project to tender advice on the selection of a suitable site for the proposed fishing harbour, has completed his work.

Tangasseri, in Quilon, and Neendakara in the Indo-Norwegian Project area, five miles west of Quilon, are the sites from which selection is to be made.

Two schemes on this subject are now being studied by the Central Water Research Station at Poona. The first envisages the cutting of a canal from Tangasseri to Ashtamudi Lake. The other proposes to keep the mouth of Asthamudi Lake open and navigable under all tidal conditions by shifting the sand back at the mouth of the lake.

Training for Fishermen

With assistance of the Food and Agriculture Organization (FAO), the Government of India organized during 1955-57 and operated with outstanding success, four training centres in teaching Indian fishermen navigation, and operation of mechanized fishing boats and modern gear and equipment.

During this period 240 fishermen have been trained and now there are another 80 under training. The remarkable thing proved at these training centres is that in a six-month training course illiterate fishermen were able to learn to use compasses, dividers and charts effectively and to operate small powered fishing boats equipped with gurdies and nylon gill nets.

The centres were set up to meet the requirements of the steadily increasing programme of mechanization of fishing craft in India. The first two centres were set up in 1955 at Satpati, Bombay State, and Veraval, Saurashtra State, and in 1956 two more were set up at Cochin, Kerala State, and Tuticorin, Madras State. The Government of India agreed to provide 50% of the funds needed to operate these centres for three years, the State Governments providing the other half of the costs.

The curriculum for the centres was to give about 20% theoretical and 80% practical training, with the accent on going to sea and putting into practice all that was taught at the training centres.

The training centre at Tuticorin provides an excellent example of the success of the scheme. Here the fishermen put their classroom training into practice by fishing with seven small "Pablo" boats, equipped with 10 h.p. engines, gurdies and nylon gill nets. Four fishermen form the crew of a boat.

After the fishermen are trained, the boat is handed over to a fishermen's federation which becomes responsible for its administration, such as payment of shares, supply of petrol and oil, repairs and maintenance, the payment of a percentage of the catch to the Government and so on. The fishermen are allowed to fish wherever they like but are required to report on the location and the catch. These reports are kept and are analysed at the training centre.

These men were so successful that, after deducting a substantial part of their catch to pay for the boat, gear and equipment on an instalment system, they still earn two

or three times as much as their fellow fishermen who still use traditional *catamarans,* canoes and local types of nets.

The training centres at the other three places are working on exactly the same lines as that at Tuticorin except that the first 20 men trained at the Cochin centre have joined the small trawlers operated by the Norwegian-India Foundation. These men are earning about three times as much as other local fishermen.

Counterpart assistants to the FAO expert assigned for these centres were trained to take over the new centres as they opened. These assistants who were biologists and had little knowledge of fishing, very quickly learned how to operate the training programme.

The centres from which small mechanized boats can operate are ideal for this type of training of fishermen. Obviously, the success of such training depends to a large extent on the opportunity for trainees for putting into practice the improved fishing techniques that they learn at the training centres.

Two new centres have been opened this year, one at Mangalore, Mysore State, on the west coast, and one at Kakinada in Andhra State, on the east coast. The Governments of other States are sending counterparts to these centres so that they can be trained to open up and run centres in their own States at a later date.

Colombo Plan Assistance

Canada has provided, under Colombo Plan, a 4-6 month course for one of India's fisheries workers in the field of offshore fisheries research. Training will commence in 1958. Offshore fishing and consequently offshore fisheries research in India are to be expanded considerably under the Second Five-Year Plan. With the success of trawl fishing, offshore fishing activities are expanding; the necessity has now arisen to study the biology of the chief species contributing to these new fisheries and also the inter-relationships of the different species. For this work, the fish stocks have to be carefully evaluated and appropriate management policies developed. Training was therefore requested in Canada, for the Assistant Research Officer, Central Marine Fisheries Research Station, Mandapam Camp (South India).

Fisheries Co-operatives

For the betterment of fishermen, the State of Kerala proposes to organise fishermen's co-operatives to cover the whole coastal belt of the State. With this object in view a course of training had been sought in Canada for an Inspector of Co-operative Societies. Canada met this request by providing a course of training which commenced in September 1957. The trainee is expected to gain a thorough knowledge of the equipment both in shore and deep sea, how these could be owned by co-operatives, supplied to fishermen for cash or on loan and be equipped with the basic principles of storing, curing and marketing the catch on a co-operative basis. On return from training, he will be posted as Special Inspector for Fishery Co-operatives to be in complete charge of the fisheries co-operatives in the State.

JAPAN

New Japanese Fishing Ventures

Japan is still extending its fishing ventures around the world. Malaya has signed an agreement with a Japanese firm for technical assistance in establishing a tuna industry. Japan will send two 300-ton tuna vessels which will fish in the Indian Ocean and off Borneo, and a cannery will be built in Penang. The tuna ships will be manned initially by Japanese.

Cuban National Fisheries Institute has signed a contract with Pesqueras Internationales, S.A., which represents a Japanese fishing company, Nippon Reizo K.K., for exploratory fishing for yellowfin and bluefin. The Japanese will not land their catches unless the Cuban industry wants extra supplies. They will export to Puerto Rico and possibly the U.S.A. The contract is for a year, with a possible extension.

Nippon Reizo K.K., through a Boston subsidiary, recently began producing frozen sugar-cured "tunaburgers" and smoked tuna loins. The "tunabergers" are sliced from a loaf pressed from chopped sugar-cured loins.

A Japanese fishing company has recently sent six fishing boats to Brazil to operate off Santos and supply the Sao Paulo market. Five of the boats are trawlers with a capacity of 60 to 100 tons of fish, and one is a purse seine vessel with a capacity of 200 tons of sardines. The Japanese company is controlled by Japanese interests but was incorporated in Brazil under Brazilian law. Under a special waiver from the (Brazil) Federal Government, it may operate its boats with Japanese crew for two years. At the end of that period the crew must all be nationalized.

A fish reduction venture, based on a factory ship of 11,800 gross tons served by 20 trawlers fishing in the eastern Bering Sea, is reported to have been approved by the Japanese Government. The venture was planned by Hokuyo Suisan K.K., a crab company, which will buy the factory ship in Finland and the reduction equipment in Denmark. West German fish meal buyers are expected to take 12,000 tons of meal in 1958. Although the primary objective is reduction, it is expected that some cod will be salted for the Mediterranean market, and filleting and freezing of cod in blocks for the manufacture of fish steaks will be undertaken on a test basis. It is reported that during the northern winter the factory ship will move to the Antarctic to work with the Dutch whaling fleet making meal out of portions of the whales not used for oil production. (*Fisheries Newsletter*, **17** (1): 13, 1958).

Development of Coastal Fishery

The Government of Japan have appropriated Y. 251,666,000 for the fiscal year beginning April 1953 and ending March 1959 in order to stablize the coastal fishery and further develop the inshore fishery. The principal features of the Project are:

1. Development of estuarine fishing grounds

Unexploited estuarine fishing grounds are to be developed for harvesting laver, short-necked clam (*Tapes phillippinarum*), clam, etc. The work includes scraping

by bulldozers, topsoiling, land adjustment, construction of waterways, breakwaters and irrigation facilities.

2. **Development of coastal fishing grounds**

Unexploited fishing grounds in coastal waters are to be developed by using such artificial constructions as *tsukiiso* (concrete fish shelter) and *gyosho* (fish nest or apartment). The former, placed at depths not exceeding few metres, provide suitable settling grounds for seaweeds and shellfish, while the latter placed in waters 20-30 metres deep, provide shelter for fish.

It is planned to develop during 1958 about 518,000 *tsubo* (1 *tsubo* = 1.8 m.sq.) of suitable water areas all along the Japanese coast by submerging *tsukiiso* while another 337,000 *tsubo* will be developed during the same year by blasting rocks in the sea-bed. In the relatively deep sea, concrete blocks will also be placed in an area of about 18,020 *tsubo*.

Gyosho or fish nest are cubic (1–1.2 $m.^3$) concrete blocks, hollow and provided with pigeon holes. Normally, 100 such blocks are piled up so as to make a large 'apartment house' for various species of fish. It is thought that the *gyosho* will help concentrate the otherwise scattered fish and thereby reduce the time and cost of scouting for them. The grounds developed with *gyosho* will normally be fished with lines.

The plans for 1958 include construction of 6 'fish apartments' and 401 'fish nests'.

PHILIPPINES

Fish Stocking Project

Fish stocking of inland waters in San Pablo city, undertaken by the Bureau of Fisheries, for the past two and a half years, is reported to have considerably increased fish production. Although San Pablo city is devoid of marine resources from which to get adequate supply of fresh fish for daily consupmtion of the people, the city is endowed with inland freshwater resources consisting of nine crater lakes, marshes and numerous streams.

To ensure an adequate supply of fish to the city, the Bureau of Fisheries undertook an intensive fish stocking programme in Sampaloc Lake, Palapakin Lake, Bunot Lake and Majikap Lake. After two years, it was estimated that 66 per cent of the annual fish production of those Lakes came from species that were stocked. This was gathered from reports of the fishermen around the Lakes. It was reported further that carp and 'bangos' *(Chanos)* being caught weighed about two kilos and 0.4 kilo each, respectively.

A fish stocking team of the Bureau of Fisheries had been stocking the Rizal side of Laguna de Bay with 'bangos' fingerlings since 7 November 1957. Up to 2 December 1957, a total of 58,000 'bangos' fingerlings had been stocked, distributed as follow: Tanay, 8,000; Baras, 14,000; Morong, 4,000; Cardona, 4,000; Binangonan, 4,000; Angono, 4,000; Taguig, 5,000; Muntinglupa,

5,000; Jala-jala, 5,000; and Pillila, 5,000. A total of 100,000 fingerlings will be stocked. The work was expected to be completed before Christmas.

The stocking of Laguna de Bay with 'bangos' fingerlings is one of the projects of the Bureau of Fisheries aimed at rehabilitating inland fisheries. It is expected that the fingerlings being stocked will grow to marketable size within a period of from ten to twelve months.

Culture of *Teuthis* sp.

Preliminary study on the raising of a *teuthid* the fish locally called 'samaral' (Tagalog, Visayas) or 'Padas' (Pangasinan, Illocano) in the marine or saltwater ponds by the Pangasinan Provincial Fishery School at Lucop, Alaminos, Pangasinan, revealed great possibilities of systematically raising the fish in pond. The fish stocked in the pond as the fingerlings reportedly attained marketable size within six months. The fry of this species is caught in large quantities in Pangasinan and the Ilocos provinces with fine mesh nets and converted to salted fish paste or 'bagoong', a product relished by people in Luzon. This practicc has considerably drained this fish resource.

The fish also ascend rivers and enter milkfish *(Chanos)* ponds where they grow and are harvested with milkfish to bolster the income from the fishpond. Non-predaceous and mainly feeding on plants, it is compatible and does not compete with the milkfish.

'Samaral' is relished as a delicacy because of the fine flavour of its firm, tasty flesh and commands a good price.

Possibilities for its systematic culture are being further looked into.

Oyster Farming Bolstered

The Bureau of Fisheries Binakayan Oyster Farm has considerably bolstered oyster farming in Bacoor Bay, Cavite. As a result of the more effective methods of oyster culture demonstrated by this Station, many oyster cultivators are now farming hundreds of hectares of the potential oyster beds of Bacoor Bay.

Another demonstration oyster farm in Manat, Pangasinan which was started as a project of the provincial government of Pangasinan has been nationalized and is now being rehabilitated by the Bureau of Fisheries. More experimental plots on the different methods of culturing oysters will be put up for demonstration purposes to encourage and help oyster farmers to exploit and utilize the oyster resources of this province.

There is a great demand for oysters all over the country. Supply is limited as the majority of oyster farms are small subsistence projects. The Philippines abounds in protected bays, coves, lagoons and coastal rivers which are potential oyster farms and await development. Oyster farming may be started as a small plot for family subsistence or as a commercial venture involving many hectares.

Harvests from natural oyster beds and and oyster farms are marketed in the shells, as fresh shucked meat and as salted oysters or 'bagoong.' The fresh shucked meat costs around P. 4.50 per gallon and oysters in the shell, P. 1.50 per kerosene can.

Technical assistance on oyster culture, particularly on species cultured, site, methods of culture and prospectus for oyster farming, is provided by the Bureau of Fisheries.

UNITED KINGDOM

NORTH BORNEO

Freshwater Pond Fish Culture

A total of 27 fish ponds was built during 1957, the majority of them were situated in the districts of Jesselton, Tuaran and Penampang. The total area of these ponds is 5.62 acres.

The use of the monosex culture technique for *Tilapia mossambica* has been increasling in the recent months. The Central Fry Breeding Station at Tuaran has been supplying male *Tilapia* fingerlings since May 1957, at 5 cents per fish, and up to the end of the year 1,656 fingerlings were sold.

During the year the Department of Agriculture distributed 7,666 fish fry, of which 3,045 were from the Tuaren and Keningau Stations and the remaining 4,621 were Chinese carps imported from Singapore.

The Chinese carps fry have been imported from Singapore by air in sealed tins and later in plastic bags under oxygen pressure since 1954. This method of transportation has been very successful, the mortality has seldom been higher than 5 %.

The Chinese carps *(Aristichthys nobilis, Hypophthalmichthys molitrix* and *Ctenophryngodon iedllus)* were introduced to this country in 1952, and were found to do very well, especially in heavily manured ponds. These fish also seemed to get on well with the *Tilapia* when they were mixed together in a single pond.

HONG KONG

Fish Culture Activities

With 2 new commercial ponds brought into use during October–December 1957, the total area now devoted to fish culture in Hong Kong is 517.25 acres.

One of the two new ponds is half an acre in area, situated at Lam Ti village near Castle Peak and the other 1.67 acres, located at Ha Tsuen in the Ping Shaan district.

Some 1,800 piculs of locally reared pond fish were harvested during the last quarter of 1957.

During the same quarter, Hong Kong exported 1,980,755 fish fry, some by air and some by sea, to Singapore, Formosa and Bangkok. The consignments consisted of 4 varieties of Chinese Carp—Grass Carp (1,163,150), Silver Carp (656.050), Big Head (156,555) and Mud Carp (5,000). These fry had all been received from the Chinese Government Fish Fry Stations at Canton, Hankow and Wu Chow.

The Kadoorie Agricultural Aid Association made loans of HK$ 1,000 and 2,000 to two fish farmers, in the Yuen Long area, for the purchase of fish fry and feed. A pump was lent by the Fisheries Division to the villagers of Leung Tin Tsuen to enable them to draw water from a nearby stream and replenish the water in their pond.

Junks Being Streamlined

Fishing junks, which have been built on exactly the same lines for centuries, are being modified in a bid to improve the efficiency of Hong Kong's busy fishing industry.

Until very recent years, junks up to 90 feet long were built by experience handed down from generation to generation. There were no line plans, no templates to ensure proper curves. The facilities and methods at the boatyards for building these junks are primitive and wasteful. Planks are shaped by burning the wood and weighting it with heavy stones. Even the cutting out of planks from logs is still being done by hand.

About 103 boatyards scattered all over the Colony, constructed 123 junks during October-December 1957. These junks consisted of trawlers, seiners, longliners gill-netters and one fish collector. They represent 68,414 piculs of capacity and cost HK$ 1,113, 126.

The Hong Kong Fisheries Department has had two trawler junks made on generally traditional lines, but incorporating certain improvements in design giving better sea-going qualities and more economical running.

The Craft Technician of the Fisheries Division designed a steam chest which was built and lent out to one of the leading junk builders for bending timber. This junk builder has shown great enthusiasm for the steam chest and has used it successfully and with advantage.

It has been proved that by adding a fillet, a wooden fairing where the bottom hull planks join the keel, and tapering off the deadwood just in front of the rudder, one of the boats became far cheaper to run. This simple underwater streamlining has resulted in considerable fuel saving—12% with the engine running at full revolution and 24% at low cruising speed. It has also been shown that a light steelplate rudder instead of the usual cumbersome wooden affair will add considerably to a junk's sailing efficiency.

Mechanization of Fishing Craft

During October-December 1957, a total of 226 mechanized fishing boats (154 of which were newly built) were licensed. Allowing for the disappearance of 26 former powered vessels which reverted to sail and one vessel transferred to the motor trading register, the total strength of the mechanized fishing fleet as at 31 December 1957, stood at 2,173 vessels. The 226 mechanized vessels comprised 81 purse-seiners, 66 longliners, 43 trawlers, 17 Pa T'eng (three masted junks of 50 feet length) 13 gill netters, 5 hand liners and 1 fish collector.

Altogether 227 diesel engines were installed in fishing junks (one vessel having twin engines). Of these 122 were of British make while the remaining 115 were foreign engines.

SINGAPORE

Storm Warning Service

The Department of Broadcasting Singapore, announced on 10 November 1957 a new storm warning service to assist mariners, fishermen, farmers, flood control and irrigation engineers and other people whose work or livelihood is affected by storms. This service is being run in

conjunction with the Meteorological Department which passes the information to Radio Malaya's newsroom as soon as a weather situation develops threatening strong winds, rough seas or heavy rains. The information is broadcast as a storm warning in whatever languages happen to be on the air at that time. Radio Malaya broadcasts in English, Malay, Chinese and Tamil.

The Department of Broadcasting has started the service to coincide with the current North-East Monsoon season. During the same season last year, a number of fishermen were caught in heavy seas off the east coast of Malaya and in Singapore waters and many fishing traps and vessels were destroyed. By instituting this new service it is hoped that such incidents will be averted.

The Fisheries Division, Singapore, licenses fishing vessels which clear for fishing in the non-territorial waters of the Indian Ocean and the South China Sea, in the seas off the coast of Malaya and in local waters serving fishing stakes (kelongs). Very few of these fishing vessels are, however, equipped with radio receivers. In order to encourage the fishermen to take advantage of this new storm warning service, the Fisheries Division is publicising the new service through the *Rural News* which is published monthly in English, Malay, Chinese and Tamil by the Department of Information Service, Singapore. The fishermen are being advised to take advantage of this new service by installing, whenever possible, radio receivers in their fishing vessels.

UNITED STATES OF AMERICA

HAWAII

1957 Most Unusual Year in the Pacific

Meteorological, oceanographic and biological data and reports, both from Pacific Oceanic Fishery Investigations (POFI) programmes and those from other activities in the Pacific, confirm the fact that 1957 was a most unusual year. Tropical storms were more frequent; the surface temperatures were from 2° to 7°F. warmer than normal and, of immediate interest to fisheries, there was a disastrous skipjack season in Hawaiian waters; albacore were reported in the Gulf of Alaska; sardine spawning off the coast of California was unique and there was a phenomenal increase in catch of many warm-water sportfish off the California coast.

Data received by POFI include those from monitoring stations, co-operating commercial vessels, U.S. Weather Bureau, POFI vessels and catch records from the Territorial Department of Fish and Game. During the quarter (October-December 1957) surface temperatures off Oahu were consistently warmer than during the same period last year (two-year record). At Christmas Island, surface temperatures during July and August were 2°F. higher

than the maximum for 1956, 3.3° F. higher than 1955. Surface temperatures recorded by the *Monterey* and *Mariposa*, travelling between Pago Pago and Honolulu, were 2 to 3°F. higher during October-December than the 80-year normal. Surface temperature anomaly charts prepared by POFI during the quarter for the area north of 20°N. latitude and east of the 180th meridian reveal that the surface temperatures in the northeast Pacific were consistently warmer than normal (30-year average) during the quarter. In some areas, the anomalies were as high as 6-8°F. A meridional temperature section across the Equator, made in December by the *Charles H. Gilbert*, revealed that the temperatures to a depth of 500 feet were 2-3°F. warmer than on a similar section made during October. There were no apparent indications on the latter section of any marked degree of upwelling at or near the Equator. It is of interest to note the presence of an extraordinary concentration of fish schools and birds near the Equator during the December section.

As to the Hawaiian skipjack fishery, a preliminary estimate shows that less than 6 million pounds of skipjack were landed in Hawaii compared with 11 million pounds for 1956. The 1957 catch was the lowest since the recovery of the fishery after the War.

Parasite Infects Young *Tilapia*

In November 1957, a heavy mortality, was experienced among the young *Tilapia* and *Tilapia* fry currently being raised in Hawaii as tuna bait fish. The mortality was caused by an ectoparasite, *Trichodina* sp. which is a ciliate protozoan. The disease caused by this organism is called Trichodiniasis. The infection was first confined to the young fish but in late December it showed up among the adults. Various treatments were given which seemed to bring temporary relief, but difficulties were experienced in sterilizing the tanks so as to prevent further outbreaks of the disease and to stop its spread.

Monthly Sea Surface Temperature Charts

As of January 1958 POFI commenced to issue monthly charts of sea surface temperatures in the North Pacific together with comparisons with the 30-year mean as a similar chart for the corresponding month of the preceding year. These charts are being prepared in connection with the POFI albacore research. They should be particularly useful in unraveling the distribution of the albacore, for sea temperature is one of the most important factors governing their occurrence.

The anomaly chart for January 1957 shows that the entire mid-ocean area was considerably warmer than average, while the coastal waters were somewhat colder than average. The January 1958 anomaly chart shows that this year the mid-ocean area is in general slightly warmer than the 30-year mean, whereas the coastal waters off California are markedly warmer than the 30-year mean. In January 1958 the mid-ocean area is considerably cooler than in the corresponding period of 1957, while the coastal waters this year are warmer than last year. Whether or not these differences foretell an eventual change on the coast to cooler water, must await further studies.

FAO ACTIVITIES

FAO Conference Reviews Fisheries Division Work

The achievements of the Fisheries Division of the Food and Agriculture Organization during 1956-57 and its programme for the succeeding two years were examined by the FAO Biennial Conference in Rome, between 2-23 November 1957. The Conference recorded its satisfaction with the way in which the Division had performed its task within the funds available and was of the opinion that the proposed programme of work was sound, adequately balanced and suitably orientated.

The progress of the Technical Assistance Programme was noted with satisfaction. Recipient countries were urged to make proper preparations before arrival of the experts, to provide suitable working facilities, necessary equipment and counterpart assistance. There was general agreement that every means should be explored to improve the method of recruitment of experts and to make more use of the assistance which national fisheries administration could provide.

Attention was drawn to the advisability of granting more fellowships, to the selection of the regions where the fellows were to be trained, and to permitting countries which were not eligible for Technical Assistance to benefit from this scheme.

It was also recommended that, in the case of fellowships, the maximum of advance information should be supplied to the country to be visited and careful programming be made in good time and adhered to.

The encouraging results obtained warranted an increase in the number of suitably selected training centres. A system of study tours for groups should be considered.

The reports of the Indo-Pacific Fisheries Council and the General Fisheries Council for the Mediterranean were received and approved, and the budget proposed by the Director-General for the Indo-Pacific Fisheries Council was adopted. The collaboration and co-operation between the Fisheries Division and these Councils were reviewed and approved.

With the increase in the number and activities of regional fisheries councils, the Conference felt, that the cost of servicing them should be studied and a policy should be recommended which would recognise the extent of FAO's role in relation to these regional councils.

Staff Travel

Dr. D.B. Finn, Director, FAO Fisheries Division, left for Australia on 16 January to give lectures at the FAO Indo-Pacific Training Centre in Fishery Co-operatives and Administration, 16 December 1957 to 25 January 1958.

After attending the closing ceremony of the Centre, Dr. Finn went to Bangkok for discussions on fishery matters. During February he continued his travels, visiting Hong Kong, Tokyo, Seoul, Seattle, Vancouver, Toronto, Ottawa, Washington and New York, before returning to Rome on 25 February. He held discussions with government officials at all these places, on the programme and policy for the development of fisheries as well as possible FAO technical assistance to the countries visited.

Dr. G. L. Kesteven, Chief, Biology Branch, FAO Fisheries Division, returned

to Rome, on 28 January 1958, from his visit to India, Ceylon, Thailand, Burma and Singapore. He went to India to discuss with Dr. N.K. Panikkar, Fisheries Development Adviser, the terms of reference and programme of a special committee to be set up to advise the Government on the establishment of an institution for higher learning in fisheries science. After working on the committee, Dr. Kesteven visited the other countries mentioned above to discuss with government officials the technical assistance programme for 1959 and other fisheries questions, particularly participation from these countries in the forthcoming Seminar on Methodology and Techniques of *Rastrelliger* Research to be held in Bangkok in October-November 1958.

While in Bangkok, Dr. Kesteven held discussion with the Department of Fisheries, Thailand, the Regional office of FAO for Asia and the Far East on the physical arrangements for the Seminar.

Mr. Jan-Olof Traung, Chief, Fishing Boat Section, FAO Fisheries Division, left Rome on 24 February 1958 on an extensive tour of Pakistan, India, Thailand, Ceylon, the Philippines, Japan and Hawaii. Apart from investigating the progress made by various FAO/ETAP experts engaged on fisheries projects in these countries, Mr. Traung will particularly strive to create enthusiasm for and to encourage participation from these countries at the Second World Fishing Vessel Congress to be held in Rome in April 1959.

Mr. Traung expects that fishing boat designers and builders in Asia and the Far East will make important contributions to this Congress.

While in India, Mr. Traung attended the Symposium on motored surf landing fishing boats organized by the Indo-Norwegian Project at Quilon between 3-8 March 1958. On his way back to Rome, Mr. Traung will also visit Canada and the U.S.A. in connection with the World Fishing Vessels Congress and discuss problems concerned with fishery research vessels.

While in U.S.A. Mr. Traung will participate in the Symposium on "Development in Boats for Surf Operations", organized by the Society of Naval Architects and Marine Engineers in San Diego, California, between 11-12 April 1958.

Documents and Publications

Publications Issued

FAO Fisheries Bulletin, Vol. 10, No. 4 (English and French).

World Fisheries Abstracts, Vol. 9, No. 1 (English).

Purposes and Methods of Fishery Statistics (Report of the First International Meeting on Fishery Statistics, held in Copenhagen, Denmark, 26–30 May 1952).

The Economics of Fisheries (Report of the IEA/FAO Round Table Meeting, held in Rome, September 1956).

Publications Planned

The Biology Branch of the FAO Fisheries Division has completed the drafts of two Manuals on Methods in Fisheries Biology. One deals with field methods and the other with laboratory methods.

The manual on field methods in fisheries biology consists of three sections. The first section describes the planning and preparation of field trips and expeditions and gives instructions on recording data; in addition, it gives numerous model forms for field records; most of these are currently in

use in active research programmes. Section 2 describes instruments and methods for observing the environment, (meteorology and oceanography) concurrently with biological work proper. The field procedures for measurements and observations are described and numerous tables, and illustrations of codes used, are given. Section 3 describes the field methods for observing biota, (plankton, benthos and nekton), but deals chiefly with the field measurements, collections and observations of fish and fish populations.

The manual on laboratory methods in fisheries biology contains descriptions of chemical and physical laboratory methods, and instructions for processing of data. Those methods have been selected and reproduced from original publications. At present, two parts of this laboratory manual have been compiled. The first contains physical and chemical methods in meteorology and oceanography (e.g. determination of chlorophyll, oxygen and nutrient salts, methods for processing oceanographic data etc.). The second part contains laboratory methods on plankton and benthos, (e.g. description of the C^{14} methods for measurement of basic organic production, determination of chlorophyll etc.). The third part will deal with fishery biology methods proper—fish measuring, counting of meristic characters, scale and otolith reading, gonad analysis, stomach contents analysis, and paper chromatography.

These two manuals are for fishery biologists and describe methods employed in the study of fish, including methods for supplementary observations generally found necessary by fishery biologists.

These manuals will be available in limited number in mimeographed form and will be submitted to many advanced workers for review before being given broader distribution. It is hoped to be able eventually to have them printed.

FAO Fisheries Bulletin Discontinued

With Vol. X, No. 4, October-December 1957 issue of the *FAO Fisheries Bulletin* the publication ceased. This Bulletin has in the past brought to interested people, at regular periods, reviews of knowledge and accounts of recent advances having bearing on fisheries development, as well as incidental news about FAO and its work. The disappearance of the Bulletin will leave a gap. However, FAO plans to continue to issue authoritative statements on recent advances in fisheries development in a non-periodical series of Fisheries Papers. These Papers may be obtained by those interested by writing to the Director of Fisheries Division, Food and Agriculture Organization, Rome and requesting to be placed on the distribution list.

TA Naval Architect for India

Mr. Peter Gurtner (Switzerland) arrived in India in January 1958 on his 12-month assignment as FAO/ETAP Naval Architect.

His terms of reference are "to give advice and assistance to the Government of India in the design and construction of mechanized fishing craft suited to local requirements".

Mr. Gurtner is a Swiss citizen and prior to this assignment has undertaken a one-month TA assignment in Tunisia as naval architect, and for the last three years has worked as naval architect in the FAO Fishing Boat Section in Rome. He studied mechanical engineering at the Swiss Federal Institute of Technology in Zurich and then naval architecture at the Royal College of

Science and Technology in Glasgow, Scotland, where he graduated in 1954.

FAO Fellowship for Indian Fisheries Officer

Mr. Davidson Thomas, Inspector of Fisheries on Pamban Island (between Southern India and Ceylon) has been awarded an FAO Fellowship for 9 months to study gill netting, longlining, trawling, purse seining and navigation. Mr. Thomas has been working with FAO/ETAP Master Fisherman in India, Mr. G.S. Illugason, as his counterpart assistant off and on since early 1954. So trained, Mr. Thomas has in turn helped train local fishermen.

During the Fellowship, Mr. Thomas will spend two and a half months in Iceland, four in U.S.A and one and a half in Italy. In Iceland, he will be given a course in elementary navigation. At the conclusion of approximately 6-7 weeks of intense studies, he will sit for a test, on successful completion of which he is expected to receive a certificate in order to enable him to act as a skipper of government motor vessels on return to his home country. Mr. Thomas will then spend time on board longliners, gill netters and small trawlers in order to observe as well as to actually take part in the operation of the gear.

In U.S.A., Mr. Thomas will divide his time evenly between shrimp trawling in the Gulf of Mexico (in shallow water from relatively small craft as well as on offshore shrimp vessels), tuna longlining in the Gulf of Mexico, and menhaden purse seining either off the East Coast or in the Gulf.

In Italy, Mr. Thomas will visit the fishing ports near about Rome, preferably with trips to sea on trawl boats (from Anzio) and boats fishing with lights and purse seine. Before returning to India, Mr. Thomas will discuss at FAO Headquarters in Rome the impressions gained by him in the various studies undertaken during the Fellowship.

IPFC AFFAIRS

Staff Movement

Mr. J.A. Tubb, Regional Fisheries Officer and *ex-Officio* Secretary of the Indo-Pacific Fisheries Council returned to Bangkok on 17 March 1958 after having spent 3 months' home leave in Australia.

8th Session of the Council

The 8th Session of the Council will be held in Colombo from 6-22 December 1958.

Rastrelliger Seminar

The Seminar on the Methodology and Techniques of *Rastrelliger* Research recommended at the 7th Session of the IPFC will be held in Bangkok in October-November 1958 under the joint sponsorship of the Food and Agriculture Organization and the Government of Thailand. The draft agreement in this respect signed *ad interim* is being finalized. It is proposed to hold this Seminar, which will last six weeks, sufficiently ahead of the 8th Session of the IPFC so that the report on the Seminar may be presented at that Session of the Council.

The draft prospectus for the Seminar is being currently revised and the preparations

for the procurement of various physical requirements are already underway.

Technical Committee Activities

Newsletters issued by Technical Secretaries to the members of Technical Committees and their panels have been well received and the response from the members is progressively increasing.

Meetings Attended

Nai Boon Indrambarya Director-General of Fisheries, Thailand and ex-Chairman, Indo-Pacific Fisheries Council, was appointed to represent the Council as an observer at the United Nations Conference on the Law of the Sea which began its 9-week deliberations in Geneva on 24 February 1958.

Documents and Publications

During the period, November 1957 to March 1958, the following documents and publications were issued by the Council:

IPFC Current Affairs Bulletin, Nos. 20 and 21.

Occasional Paper 57/2 – Fishery programmes in relation to Agricultural and economic planning.

,, ,, 57/3 – National fisheries policy and programme.

,, ,, 57/4 – Differences in the food of the young and the adult Indian mackerel, *Rastrelliger kanagurta* (Cuv.), by K.V.N. Rao and K.P. Rao. (Extract from *Nature*, **180** (4588): 711-712, 1957).

,, ,, 57/5 – Shifting cultivation and inland fisheries, by J.A. Tubb.

APPEAL

Of late there have been heavy demands for the IPFC publications particularly, the *Proceedings* of the various Sessions and the *Current Affairs Bulletin*. Unfortunately, it has not always been possible to meet these demands as some of these publications are **completely out of stock.**

It will be greatly appreciated; if our readers possessing spare copies particularly, of the *Proceedings* of the 1st-4th Sessions (Meetings) including Technical and Symposium papers, (Section II and III) and No. 17 of the *Current Affairs Bulletin*, would please forward them to the Council Secretariat. Any expenditure incurred in mailing would be gladly reimbursed by the Secretariat.

PERSONALIA

Dr. Rolf L. Bolin, Professor of Biology at Stanford University, California, arrived in Hong Kong in October 1957, on a Fulbright award, to undertake research with the Fisheries Research Unit of the University of Hong Kong.

During his one year stay in Hong Kong, Dr. Bolin's work will include the preparation of an authoritative list of the marine fishes of the waters around Hong Kong and the gathering of representative collections of fishes from both inshore and offshore grounds.

Dr. Bolin is 56 years of age and has been associated with Stanford University since 1928, having taken his M.A. degree there in 1929. He has held a succession of increasingly important posts in the Department of Biology in that University and became Professor in 1948. He is also attached to the Hopkins Marine Station, Pacific Grove, California.

Dr. S. Jones, Research Officer, Central Marine Fisheries Research Station, Mandapam Camp, South India, was appointed Chief Research Officer of the same Station effective 26 April 1957 *vice* Dr. N.K. Panikkar who was appointed Fisheries Development Adviser to the Government of India. (See *IPCF Current Affairs Bulletin*, No. 19 : 37, 1957).

Dr. Jones is one of the leading fisheries biologists of India and has several technical publications at his credit. He takes an active interest in the *Rastrelliger* programme of the Indo-Pacific Fisheries Council.

CURRENT READING

Allgemeine Meereskunde: Eine Einfuhrung in die Oceanographie, by G. Dietrich, and K. Kalle, Gebruder Borntraeger, Berlin, 1957, viii + 492 pp., 223 text figures, 30 text plates and 7 loose folding plates, Price: DM. 56.

It is fifteen years since Sverdrup, Johnson and Fleming's 'The Oceans' appeared. The time is now ripe for another standard text-book of general oceanography. Dietrich has met the need with a book which combines the German gift for accurate detail with clear and concise presentation of broad issues. He has used a direct prose style free from the grammatical tangles which may make the German language so difficult for those who have not mastered it.

His colleague, Kurt Kalle, has contributed a chapter of sixty pages on the geochemistry, biochemistry and productivity of sea water. This is the only chapter into which biological matters enter. The remaining 400 pages are devoted to physical oceanography, all branches of which are covered more than adequately. Where all is so good it is not easy to select one section for special mention. Mathematics is used when necessary but no biologist need fear that he will be overwhelmed by formulation of which he has neither need nor interest. An English translation of this excellent book with such a distinctive approach ought to sell well.

Use of Infrared Radiation in the Study of Fish Behaviour, by Rea, E. Duncan, *Special Scientific Report— Fisheries*, No. 170, *Fish and Wildlife Service, United States Department of the Interior, Washington, D.C.*

Observation of fish behaviour in the dark is possible through the employment of infrared radiation. Experiments have demonstrated that the behaviour of fingerling coho salmon was not affected by infrared radiation. The infrared filter used did not pass wavelengths visible to an observer, and the actions of the fish were observed through an infrared viewer. The fish were not attracted or repelled by steady radiation, and they did not exhibit a fright reaction to flashing radiation.

The Processing of Dried Salted Fish, by S.A. Beatty and H. Fougere, *Bulletin* No. 112, *Fisheries Research Board of Canada, Ottawa*, $0.30.

The English edition of the Research Board's *Bulletin* No. IX (Methods of Handling Fish. 1. The Processing of Dried Fish, by A.G. Huntsman) has been out of print for a considerable time. From its first issue in 1927 that *Bulletin* was popular and a reprinting had been under consideration for some time. However, during the period since it was issued the knowledge of the chemistry and bacteriology of the preservation of fish by salt has been extended and the drying of fish is now largely carried out in-doors in well-designed tunnels under the control of the operator. For these reasons, while that portion of the original *Bulletin* concerned with the dressing of fish has been left intact, the present *Bulletin* has been extended to include sections concerned primarily with the bacteriology and the chemistry of fish salting, and artificial drying.

This *Bulletin* has been written by members of the staff of the Research Board's Technological Stations at Halifax, N.S. and Grande Riviere, P.Q., and the Technological Unit at St. Johns, Newfoundland. Staff members who contributed are S.A. Beatty, H. Fougere, C.H. Castell, H.P. Dussault, W.J. Dyer, M.A. Foley, W. A. MacCallum and A.L. Wood.

The Economics of Fisheries, edited by Ralph Turvey and Jack Wiseman. *Fisheries Division, FAO, Rome*, Italy. xii + 234 pp., diags., tables. 1957. Free.

The book contains the background papers and discussions of a Round Table Meeting organized by the International Economic Association in collaboration with the Food and Agriculture Organization (FAO), September 1956, Rome, Italy. The Meeting was held at FAO Headquarters and was attended by 19 distinguished economists from 10 countries. They discussed the nine papers which are now published in "The Economics of Fisheries". Two papers deal with cost conditions, three are concerned with fishery regulations, and two with marketing. One paper discusses special problems of fisheries in under-developed countries while another deals with the problems of Iceland's fisheries.

The introduction to this book is contributed by Mr. Ralph Turvey, Reader in Economics, University of London. "Perhaps the most universal feature of the world's fisheries is the high degree of uncertainty attached to estimates of the proceeds of the catch", Mr. Turvey writes in his introduction. "This risk . . . . . has a quantity element and a price element". He goes on to examine briefly the nature and effects that these risks have on the fishing industry. He also touches on the problems concerned with

consumer demand and the relationship between the cost of fishing and the size of the fish population.

Mr. Turvey concludes the introduction by pointing out that more problems were posed than solved at the Round Table Meeting. The participants "ended the Meeting with ideas for further work" and the volume, "The Economics of Fisheries", will, it is hoped, stimulate research in the field of fishery economics.

A limited number of copies are available to economists and other interested persons, free of charge.

MEETINGS AND CONFERENCES

Symposium on the Boat and the Beach

This Symposium organized jointly by the Indo-Norwegian Foundation, Quilon, India and the Government of India, was held at Quilon at the Headquarters of the Indo-Norwegian Foundation between 3 to 8 March 1958.

Participants at the Symposium were technical officers of the State Departments of Fisheries in India who are concerned with design and construction of fishing boats, and who were and/or are working as counterparts to FAO/ETAP naval architects on assignment in India. Two such naval architects, Mr. Ziener and Gurtner also participated. On a special invitation from the Foundation, Mr. Jan-Olof Traung, Chief of the Fishing Boat Section, FAO Fisheries Division, Rome, also participated.

Among the topics discussed were:

(a) The technique of adequate testing of surf boats.
(b) Review of beach landing experiments elsewhere.
(c) Economic aspects of mechanised and non-mechanised beach fisheries.
(d) Comparison of mechanised boats with local craft.
(e) Mechanical versus manual handling of boats on the beach.
(f) Constructional problems related to the boats and engine.
(g) Organizational aspects in future experiments.
(h) Maximum utilization of space in fishing boats used for multi-purpose fishing methods.

During the Symposium a new type of surf landing fishing boat, based on the results of surf landing fishing boat trials held by FAO/ETAP naval architects on the East Coast of India in 1955 and built recently in Norway was tried, along with the other surf landing fishing boats on the Kerala Coast. These trials will be continued also after the Symposium.

INPFC Annual Meeting

The fourth annual meeting of the International North Pacific Fisheries Commission was held in Vancouver, B.C., Canada, 4-9 November 1957. The meeting emphasized once again the intensive efforts being made by the 3 member countries—Canada, Japan and the Uuited States—to conserve and wisely utilise the salmon stocks of the North Pacific ocean which is regarded as one of the world's great continuing resources.

The report presented by the Committee on Biology and Research showed that scientists of all three countries had carried out an extensive and diversified programme of research during the past year. These studies followed three lines—offshore distribution, tagging and racial studies—the latter including such factors as studies of scales, blood chemistry, bone structure and other physical characteristics of salmon. Oceanographic surveys were also carried out over very wide areas and added greatly to the knowledge that the Commission has accumulated on the ocean life of the Pacific salmon species.

During 1957, fourteen ocean-going research vessels from the three nations occupied stations in a huge area extending from the North American coast off San Francisco to the coast of Japan and northward through the Aleutians and into the northern regions of the Bering Sea. Exploratory fishing vessels made thousands of hauls with floating gillnets several miles long to determine the presence or absence of salmon in various locations. Many thousands of salmon were collected at stations throughout their high-seas range and frozen for shipment to shore laboratories where their characteristics were studied by specialized scientists to determine their continent of origin. Specially-equipped oceanographic vessels made intensive studies of the characteristic of the waters of the North Pacific to relate the distribution and movement of salmon to the characteristics and changes in the ocean environment.

Vessels specially equipped for tagging were successful in capturing many thousands of salmon in vigorous condition on the high seas and applying tags which, when subsequently captured at inshore areas, indicated the direction of movement of the salmon towards their home streams.

Samples of salmon of the five species were collected from spawning streams and coastal fisheries in an arc extending around the Pacific from the shores of Japan to the Aleutians and Bristol Bays, along the coast of Alaska and British Columbia, and southward beyond the Columbia River. Studies of these samples whose fresh-water origin is known, enabled the scientists to compare their inherited and acquired characteristics with those of salmon of unknown origin taken on the high seas. Specialists in parasitology, biochemistry, statistics, physiology, serology, osteology and other sciences contributed their specialized skill in all three countries.

The data obtained so far show that there is a continous distribution of salmon across the North Pacific. But it does not necessarily follow that there is intermingling or mixing of the stocks of salmon of North American origin and of Asian origin throughout the entire area of distribution. However, there is apparently no line of separation between all stocks of Asian origin and all stocks of North American origin. Salmon have been taken from the shores of Asia to the shores of North America in all waters north of approximately 40° N. latitude in winter and 48° N. latitude in summer. The distribution extends as far northward into the Bering Sea as the research ships have been able to operate.

There is a strong indication from results to date that salmon from Asia and salmon from the portions of Alaska west of Kodiak mingle in the central areas of the North Pacific ocean. The degree of mixing and the extent of offshore movement appear to differ to some extent with the species involved.

The necessity to continue research on a substantial scale was emphasized and broad

plans were accepted for a continuation of the scientific studies in the coming year along the foregoing lines.

The Commission's 1958 meeting will be held in Tokyo. Officers elected for the coming year are: Chairman, Iwao Fujita, Tokyo, Japan; Vice-Chairman, Edward W. Allen, Seattle, Washington; Secretary, George R. Clark, Ottawa, Canada.

Meeting on Costs and Earnings of Fishing Enterprises

The FAO Technical Meeting on Costs and Earnings of Fishing Enterprises will, at the invitation of the Government of the United Kingdom, be held in London, 8-13 September 1958. It is hoped that about 30 well-qualified participants, who have had direct experience of costs and earnings studies related to primary fishing enterprises, will attend the Meeting. Sir A. Louis Chick, K.B.E., Chairman of the U.K. White Fish Authority, has agreed to act as Chairman of the Meeting. Mr. F.E. Popper, Chief of the Economics Branch, FAO Fisheries Division, Rome, will represent FAO. Mr. F.S. Allen of the Ministry of Agriculture, Fisheries and Food, London, will be responsible for local services and arrangements. Mr. K. Rasmussen, Head of the Department of Agricultural Economics of Nottingham University, has been designated Technical Secretary of the Meeting.

The prospectus and agenda for this Meeting, which have already been prepared, will soon be sent out with letters of invitation to governments and private organizations.

Second World Fishing Vessel Congress

The 2nd World Fishing Vessel Congress, being organized by the Food and Agriculture Organization (FAO), Rome, will be held on 5-10 April 1959 in Rome at FAO Headquarters.

Mr. Jan-Olof Traung, Chief of the Fishing Boat Section, Fisheries Division, FAO, has been appointed Secretary. It is expected that upwards of 300 participants will attend the Congress. They will be representatives of governments, naval architects, boat builders and other people concerned with the design and construction of fishing boats.

The draft prospectus circulated to governments, institutions and individual naval architects for comments includes such subjects as: *Engineering:* Deck Gear, Machinery, Auxiliaries, Electricity; *Practical Shipbuilding*: Scantlings, Fish Holds, Safety at Sea, Costs; *Hull Shape:* Stability, Seakindliness, Resistance, Propulsion; and *Vessel Types:* Shortdistance fishing, Surface fishing, Bottom fishing, Factory ships and Research Vessels.

The First International Fishing Boat Congress was organized by FAO in 1953 and joint meetings were held in Paris and Miami (Florida, U.S.A.). This Congress was outstandingly successful in pooling knowledge, experience and ideas concerning fishing boat design and construction in all parts of the world, and the papers and discussions were published in a book, "Fishing Boats of the World".

The forthcoming Congress will review the technical developments and progress made in fishing boat design and construction since 1953 and will carry further the international exchange of knowledge, experience and ideas in this field. The discussions and papers of this Congress will also be published in book form.

FORTHCOMING CONFERENCES, MEETINGS AND TRAINING CENTRES
1958

April	1–2	2nd International Symposium on Freezing and Drying	London
,,	8–14	International Union of Biological Sciences (IUBS) – Symposium on Classification of Brackish Water	Venice
,,	9–14	International Association of Theoretical and Applied Limnology (IAL) – Symposium	Venice
,,	11–12	Symposium on Development of Boats for Surf Operations	San Diego, California
,,	–	Economic Commission for Asia and the Far East (ECAFE) Working Groups of Statisticians	Bangkok
,,	(2 weeks tentative)	Symposium on Marine Sciences in the Red Sea and Adjacent Waters followed by Refresher Course on Marine Sciences	Ghardaga, Egypt
April-May		ECAFE–Study Tour on Water Resource Development	Undetermined
May	5–7	International Advisory Committee on Research in the Natural Sciences Programme of UNESCO	Paris
,,	5–9	UN – ECE (Economic Commission for Europe) – Inland Transport Committee – Working Party on Transport of Perishable Foodstuffs	Geneva
,,	7–9	UN Advisory Committee on Peaceful Uses of Atomic Energy	Geneva
,,	14–24	South Pacific Commission–9th Meeting of Research Council	Noumea
,,	–	ECAFE – Working Party on Community Development	Bangkok
June	3–11	Symposium on Quantitative Biology	Cold Spring Harbor
,,	4–26	International Labour Organization (ILO) – 42nd Session of the Conference	Geneva
,,	4–7	International Commission for the Northwest Atlantic Fisheries (ICNAF) – Meeting of the groups of Advisors and Standing Committee on Research and Statistics	Halifax, Canada
,,	23–27	ECE – Working Party on Standardization of Perishable Foodstuffs	Geneva
,,	30–July 4	Joint Meeting of the Association Technique Maritime et Aeronautique and the Institute of Naval Architects, London	Paris
,,	–	UNESCO – Symposium on the peaceful uses of Atomic Energy	Sydney

June	–	XVI[e] Congress des Peches et Industries Maritimes	Ostende and Brussels
July	7	International Trust for the Zoological Nomenclature – Colloquium on Zoological Nomenclature	London
„	14–29	Fiera di Ancona	Ancona
„	16–23	16th International Congress of Zoology	London
„	–	International Union of Biological Sciences (IUBS) – 13th General Assembly	
?	–	International Whaling Commission (IWC)	Dublin
July–August		South Pacific Commission – Technical Meeting on Co-operatives	Port Moresby, New Guinea
August	4–9	7th Congress for Microbiology	Stockholm
„	10–16	International Congress on Radiation Biology	Burlington, Vermont
„	11	6th Fisheries Conference of the North	Hindsgarl, Denmark
„	13–19	3th International Seaweed Symposium	Galway, Ireland
„	20–27	Australian and New Zealand Association for the Advancement of Science - 33rd Congress	Adelaide
„	20–27	10th International Congress of Genetics	Montreal
29 August – 1 September		4th International Biometric Conference	Ottawa
September	1–14	2nd International Conference of the Peaceful Uses of Atomic Energy	London
„	3–6	International Institute of Refrigeration – Commission IV	Moscow
„	5–19	International Commission on Large Dams of the World Power Conference – 6th International Congress on Large Dams	New York
„	8–13	FAO Technical Meeting on Costs and Earnings of Fishing Enterprises	London
„	9–10	American Fisheries Society – 88th Annual Meeting	Philadelphia
„	27 ($2\frac{1}{2}$ wks.)	South Pacific Commission – 18th Session	Noumea, New Caledonia
October	4–8	International Congress of Hydro-Climatology	Lacco Ameno
„	5–9	Permanent International Committee on Canned Foods	Brussels
„	13–18	General Fisheries Council for the Mediterranean (GFCM) – 5th Meeting	Rome
„	–	North Pacific Fisheries Commission	Tokyo
„	–	Permanent Commission of the International Fisheries Convention (1946)	London

October –	International Council for the Exploration of the Sea	Copenhagen
„ (4 days)	UNESCO – Symposium on Salinity Problems	Teheran
„ (3 days tentative)	UNESCO International Advisory Committee on Marine Sciences (IACOMS) – 3rd Session	Rome
„ (5 days)	U.N./UNESCO Planning Meeting for the Study of Peaceful Utilization of Atomic Energy	U.K. (tentative)
November –	Society of American Naval Architects	New York
„ –	US National Research Council and US National Academy of Sciences – International Conference on Scientific Information	Washington
? –	European Inland Fisheries Advisory Committee	Austria or Switzerland
December 6–22	Indo–Pacific Fisheries Council (IPFC) – 8th Session	Colombo
„ 11–19	International Union for the Conservation of Nature and Natural Resources	Athens
2nd half of year	Scientific Council for Africa South of the Sahara (CSA) – Symposium on Sea Fisheries on the West Coast of Africa	Cape Town
Undet	Gulf and Caribbean Fisheries Institute – 11th Annual Meeting	Miami

TRAINING CENTRES

October-November	FAO/ETAP/IPFC Seminar on Methodology and Techniques of *Rastrelliger* Research	Bangkok

1959

April 5–10	FAO World Fishing Vessel Congress – 2nd Congress	Rome
April-May	South Pacific Commission – 4th South Pacific Conference	Malaguna, (Rabaul) Papua and New Guinea
August 19–26	10th International Refrigeration Congress	Copenhagen
„ 20–8 September	14th International Limnological Congress	Vienna
„ (tentative)	Technical Meeting on Fishery Co–operatives	Goteborg
September 21–26	World Meeting on the Biology of Sardines	Rome
„ 25–4 October	International Fisheries Fair	Copenhagen
2nd quarter 1959	5th International Congress on Combustion Engines	Germany

IMPORTANT IPFC PUBLICATIONS

PROCEEDINGS (Records of Council Sessions, normally held once every 18 months).

First Meeting, Singapore, 24–31 March 1949.
- Section I: Report of Proceedings.
- Section II: Working Papers.
- Section III: Contributed Papers.
- Section IV: Symposium Papers.

Second Meeting, Cronulla, N.S.W., Australia, 17–28 April 1950.
- Section I: Report of Proceedings.
- Section II: Technical Papers.
- Section III: Symposium Papers.

Third Meeting, Madras, India, 1–16 February 1951.
- Section I: Report of Proceedings.
- Section II: Technical Papers.
- Section III: Symposium Papers.

Fourth Meeting, Quezon, Philippines, 23 October–7 November 1952.
- Section I: Report of Proceedings.
- Section II: Technical Papers and Symposium Papers.

Fifth Meeting, Bangkok, Thailand, 22 January–5 February 1954.
- Section I: Report of Proceedings.
- Section II: Technical Papers.
- Section III: Symposium Papers.

Sixth, Session, Tokyo, Japan, 30 September–14 October 1955.
- Section I: Report of Proceedings.
- Section II: Technical Papers.
- Section III: Symposium Papers.

CURRENT AFFAIRS BULLETIN (Quarterly).

No. 1–21, July 1951–March 1958.

SPECIAL PUBLICATIONS (Irregular).

No. 1: Schuster, W.H. 1952. Fish Culture in Brackish-water Ponds of Java. 1-143 pp.

No. 2: Anonymous, 1952. Fish Culture in Indonesia. 1-126 pp.

No. 3: Zaneveld, J.S. 1955. Economic Marine Algae of Tropical South and East Asia and their Utilization. 1-55 pp.

OCCASIONAL PAPERS (Irregular, Mimeo).

No. 52/3. An Annotated Bibliography on the Culture of Milkfish, *Chanos chanos* (Forskal), by Walter H. Schuster.

No. 52/9. Control of the Quality of Salted Dried Fish, by M. Lafont.

No. 52/10 A. Bibliography of Fishing Gear Preservative, by B.Y. Datingaling anp J.I. Sulit.

No. 54/1. The Status of the Fisheries in River Basin Development, by C. Miles and T.J. Job.

No. 55/2. Sampling Methods used in Japanese Fisheries Catch Statistics, by T. Yamamoto.

No. 57/1. Documents Published by and otherwise Contributed or Presented to IPFC through 1948-1956.

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